

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Priority Application Serial No. 09/148,723
Priority Filing Date September 3, 1998
Inventor Warren M. Farnworth et al.
Assignee Micron Technology, Inc.
Priority Group Art Unit 3729
Priority Examiner A. Tugbang
Attorney's Docket No. MI22-1839
Title: Methods of Bonding Solder Balls To Bond Pads on a Substrate

PRELIMINARY AMENDMENT

To: Assistant Commissioner for Patents
Washington, D.C. 20231

From: Frederick M. Fliegel, Ph.D.
(Tel. 509-624-4276; Fax 509-838-3424)
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601 W. First Avenue, Suite 1300
Spokane, WA 99201-3817

Sir:

This is a preliminary amendment accompanying a Request for Continuation Application for the above-entitled patent application. Prior to examining the application, please enter the following amendments.

AMENDMENTS

In the Specification

At page 1, after the title insert:

CROSS REFERENCE TO RELATED APPLICATION

This is a Division of U.S. Patent Application Serial No. 09/148,723, filed September 3, 1998, entitled "Methods of Bonding Solder Balls to Bond Pads on a Substrate".

In the Claims

Cancel claims 1-3.

4. (Amended) The method of bonding solder balls of claim 12, wherein said placing comprises placing individual solder balls within individual holes within the frame.

5. (Amended) The method of bonding solder balls of claim 12, wherein said placing comprises placing majority portions of individual solder balls within individual holes within the frame.

6. (Amended) The method of bonding solder balls of claim 12, wherein said exposing comprises laser bonding the balls with their associated bond pads.

7. (Amended) The method of bonding solder balls of claim 12, wherein said exposing comprises laser bonding the balls with their associated bond pads by fixing the position of the frame and moving a laser beam relative to the frame from ball-to-ball.

8. (Amended) The method of bonding solder balls of claim 12, wherein said exposing comprises laser bonding the balls with their associated bond pads by fixing the position of a laser beam and moving the frame relative to the laser beam from ball-to-ball.

9. (Amended) The method of bonding solder balls of claim 12 further comprising moving the frame away from the substrate.

10. (Amended) The method of bonding solder balls of claim 12 further comprising after the exposing of the balls, moving the frame away from the substrate.

11. (Amended) The method of bonding solder balls of claim 12, wherein:

said placing comprises placing individual solder balls within individual holes within the frame; and

said exposing of the balls comprises reflowing the solder balls while the balls are within their individual holes, and further comprising after said reflowing removing the frame from around the reflowed balls.

12. (Amended) A method of bonding solder balls to bond pads on a substrate comprising:

placing at least portions of a plurality of solder balls within a frame and in registered alignment with individual bond pads over a substrate by dipping the substrate into a volume of balls; and

while the ball portions are within the frame, exposing the balls to bonding conditions effective to bond the balls with their associated bond pads, wherein said placing comprises placing said ball portions on fluxless bond pad surfaces.

Cancel claim 13.

14. (Amended) The method of claim 18, wherein the holes are sized to receive a majority portion of an associated solder ball.

15. (Amended) The method of claim 18, wherein the holes are sized to receive a majority portion of only one associated solder ball.

16. (Amended) The method of claim 18, wherein said delivering of the individual balls comprises rolling at least one ball over a frame surface until the one ball drops into an associated hole.

17. (Amended) The method of claim 18, wherein said delivering of the individual balls comprises rolling a plurality of balls over a frame surface until individual balls drop into respective associated individual holes.

18. (Amended) A method of bonding solder balls to bond pads on a substrate comprising:

providing a frame having a plurality of holes sized to receive individual solder balls;

delivering individual balls into the holes from over the frame by dipping the frame into a volume of balls;

placing the balls into registered alignment, while the balls are in the holes, with a plurality of individual bond pads over a substrate; and

bonding the balls in the absence of flux with their individual associated bond pads, wherein said placing of the balls into registered alignment comprises moving the frame to proximate the substrate before any of the balls are delivered into the holes.

Cancel claim 19.

20. (Amended) The method of claim 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads.

21. (Amended) The method of claim 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads by fixing the position of the frame and moving a laser beam relative to the frame from ball-to-ball.

22. (Amended) The method of claim 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads by fixing the position of a laser beam and moving the frame relative to the laser beam from ball-to-ball to effectuate the bonding.

Cancel claims 23-44.

New Claims

45. A method of bonding balls of solder to bond pads on a substrate comprising:

contemporaneously retaining first and second balls of solder over different respective first and second bond pads on a substrate; and

with the first and second balls of solder so retained, sequentially exposing the first and second solder balls to bonding conditions in the absence of flux effective to (i) melt each of the first and second balls of solder and then (ii) cool each of the first and second molten balls of solder to bond each of the first and second balls of solder with their associated first and second bond pads.

46. The method of claim 45, wherein exposing comprises sequentially laser-bonding each of the first and second balls of solder.

REMARKS

Claims 4-12, 14-18 and 20-22 have been amended, claims 1-3, 13, 19 and 23-44 have been canceled and new claims 45 and 46 have been added. Claims 4-12, 14-18, 20-22, 45 and 46 are pending in the application. This preliminary amendment accompanies a request for a divisional application. Examination on the merits is requested.

The amendments to the claims and new claims 45 and 46 are supported at least by text appearing at p. 4, line 9 through p. 9, line 15 of the specification as originally filed. No new matter is added by the amendments to the claims or by new claims 45 and 46. Claims 4-12, 14-18, 20-22, 45 and 46 distinguish over the art of record and are allowable.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) are captioned "**Version with markings to show changes made.**"

This application is believed to be in condition for allowance and action to that end is requested. The Examiner is requested to telephone the undersigned in the event that the next office action is one other than a Notice of Allowance. The undersigned is available during normal business hours (Pacific Time Zone).

Respectfully submitted,

Dated: Oct 8, 2001

By: 

Frederick M. Fliegel, Ph.D.
Reg. No. 36,138

Version with markings to show changes made.

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37 CFR §1.121(b)(1)(iii) AND 37 CFR §1.121(c)(1)(ii)
FILING REQUIREMENTS TO ACCOMPANY PRELIMINARY AMENDMENT

Deletions are bracketed, additions are underlined.

In the Specification

At page 1, the following paragraph has been inserted after the title:

CROSS REFERENCE TO RELATED APPLICATION

This is a Division of U.S. Patent Application Serial No. 09/148,723, filed
September 3, 1998, entitled "Methods of Bonding Solder Balls to Bond Pads
on a Substrate".

In the Claims

Claims 1-3, 13, 19 and 23-44 have been canceled and claims 45 and 46 have been added.

4. (Amended) The method of bonding solder balls of claim [3] 12, wherein said placing comprises placing individual solder balls within individual holes within the frame.

5. (Amended) The method of bonding solder balls of claim [3] 12, wherein said placing comprises placing majority portions of individual solder balls within individual holes within the frame.

6. (Amended) The method of bonding solder balls of claim [3] 12, wherein said exposing comprises laser bonding the balls with their associated bond pads.

7. (Amended) The method of bonding solder balls of claim [3] 12, wherein said exposing comprises laser bonding the balls with their associated bond pads by fixing the position of the frame and moving a laser beam relative to the frame from ball-to-ball.

12. (Amended) [The method of bonding solder balls of claim 3]

A method of bonding solder balls to bond pads on a substrate comprising:

placing at least portions of a plurality of solder balls within a frame and in registered alignment with individual bond pads over a substrate by dipping the substrate into a volume of balls; and

while the ball portions are within the frame, exposing the balls to bonding conditions effective to bond the balls with their associated bond pads, wherein said placing comprises placing said ball portions on fluxless bond pad surfaces.

14. (Amended) The method of claim [13] 18, wherein the holes are sized to receive a majority portion of an associated solder ball.

15. (Amended) The method of claim [13] 18, wherein the holes are sized to receive a majority portion of only one associated solder ball.

16. (Amended) The method of claim [13] 18, wherein said delivering of the individual balls comprises rolling at least one ball over a frame surface until the one ball drops into an associated hole.

17. (Amended) The method of claim [13] 18, wherein said delivering of the individual balls comprises rolling a plurality of balls over a frame surface until individual balls drop into respective associated individual holes.

18. (Amended) [The method of claim 13]

A method of bonding solder balls to bond pads on a substrate comprising:

providing a frame having a plurality of holes sized to receive individual solder balls;

delivering individual balls into the holes from over the frame by dipping the frame into a volume of balls;

placing the balls into registered alignment, while the balls are in the holes, with a plurality of individual bond pads over a substrate; and

bonding the balls in the absence of flux with their individual associated bond pads, wherein said placing of the balls into registered alignment comprises moving the frame to proximate the substrate before any of the balls are delivered into the holes.

20. (Amended) The method of claim [13] 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads.

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21. (Amended) The method of claim [13] 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads by fixing the position of the frame and moving a laser beam relative to the frame from ball-to-ball.

22. (Amended) The method of claim [13] 18, wherein the bonding of the balls comprises laser bonding the balls with their individual associated bond pads by fixing the position of a laser beam and moving the frame relative to the laser beam from ball-to-ball to effectuate the bonding.

END OF DOCUMENT